# Computer Games

The term "computer games" encompasses a broad range of
computer programs ranging from fast-moving shoot-em'-ups on alien
worlds to enormously sophisticated business and military simula-
tions.  Even most hand-held and stand-alone video games designed
to be played with a television set incorporate a microprocessor
and thus can be considered computer games.

Computers weren't invented to play games.  In fact, in the
50's and 60's, with computer time both scarce and expensive,
writing games for the fun of it was actively discouraged at most
computer centers.

Nevertheless, there were many other reasons than just plain
fun for writing computer games.  Common reasons included explor-
ing the power of the computer, improving understanding of human
thought processes, producing educational tools for managers or
military officers, simulating dangerous environments, and provi-
ding the means for discovery learning.

Let us consider some of the landmarks in the field of
computer games.  In some sense, it all started in 1950 when Alan
Turing proposed his famous imitation game in the article,
"Computing Machinery and Intelligence" published in Mind maga-
zine.  Never programmed by Turing himself, some 13 years later, a
variation of Turing's "game" was was put in the form of a
computer program, Eliza, by Joseph Weizenbaum at MIT.

In 1952, behind a cloak of secrecy, the first military
simulation games were programmed by Bob Chapman and others  at
Rand Air Defense Lab, Santa Monica, CA.  In the same year, a
number of "formula" games (Nim, etc.) and "dictionary lookup"

games (Tic-Tac-Toe, etc.) were programmed for several early computers.  Also in 1952, a computer was specially designed to play Hex, a game with no exact solution, by E.F. Moore and Claude Shannon at Bell Labs, NJ.

In 1953, Arthur Samuel first demonstrated his Checkers program on the newly unveiled IBM 701 computer at IBM Corp. in Poughkeepsie, NY.  Later that year, the book, "The Complete Strategyst" by J.D. Williams was published by RAND Corp.  This was the first primer on Game Theory and provided the theoretical foundation for many early computer game programs.

The first computer game of blackjack was programmed in 1954 for the IBM 701 at the Atomic Energy Lab at Los Alamos, NM.  Also in 1954, a crude game of pool--perhaps the first non-military game to use a video display--was programmed at the Univ. of Michigan.

In the area of simulation games, the military set the pace for many years and in 1955 Hutspeil, the first theater-level war game (NATO vs USSR), was programmed at the Research Analysis Corp. in McLean, VA.

Although Newell, Shaw, and Simon are frequently credited with the first chess game--probably because they stayed at it for over 20 years--the first computer version of chess was actually programmed in 1956 by Kister, Stein, Ulam, Walden, and Wells on the MANIAC-I at the Los Alamos Atomic Energy Lab.  The game played on a simplified 6 x 6 board and examined all possible moves two levels deep at the rate of 12 moves per minute.  It played similar to a human player with about 20 games experience. In contrast, Deep Thought, the reigning computer chess champion

in 1990 examines about 1.5 million moves per second and uses a combination of brute force and intuitive play on a standard board.  Although rated at about 2500 on the FIDE system, which places it among the top 30 human players in the world, Deep Thought was decisively defeated by Gary Kasparov in a two-game match in October 1989.

In the mid-50's, it may have seemed like the AEC was sponsoring computer game research because in addition to black-jack and chess at Los Alamos, in 1958 a tennis game was designed for an analog computer at Brookhaven Nat'l Lab by Willy Higinbothan.  This game, played on an oscilloscope display, was significant in that it was the first video game to permit two players to actually control the direction and motion of the object moving on the screen (the ball).

In 1959, large-scale simulation games moved into the private sector with the programming of "The Management Game" by Cohen, Cyert, Dill and others at Carnegie Tech, Pittsburgh, PA.  This game, programmed in the language GATE on a Bendix G-15 computer, simulated competition between three companies in the detergent industry and integrated modules on marketing, production, finance, and research.  Modified and updated for newer computers, but still in use at many graduate schools of business today, this game has certainly set the record for the longest life of any computer game ever written.

With the deleivery in 1959 of the first Digital Equipment PDP-1 with its 15" video display, the continuing evolution from text-only games to video games was hastened.  Written by Slug Russel, Shag Gratz, and Alan Kotok, the first game for the PDP-1

was Spacewar, first demonstrated at an MIT open house in 1962.

Later in 1962, Omar K. Moore at Yale built a device called "The Talking Typewriter" for teaching reading to young children. In the device, built by Edison Electric, a computer controlled a video display, slide projector, and audio recorder. In 1964, a more general-purpose computer assisted instruction (CAI) system using IBM hardware including a CRT with graphics, light pen, and audio was developed by Patrick Suppes at Stanford.

Military research was still forging ahead and in 1964 Bunker-Ramo demonstrated a CRT display which simultaneously combined computer data with a projected background.

Artists began to get into the picture in 1964 when A. Michael Noll at Bell Labs produced the first computer art on a CRT display. Many years later, spurred by such companies as Activision, Lucasfilm Games and Cinemaware, artists began to play a much larger role in the creation of computer games.

Rounding out the landmark year of 1964, the language Basic was developed by John Kemeny and Tom Kurtz on the GE 225 timesharing system at Dartmouth College. Within a few months, the first interactive educational games and simulations began to appear on the Dartmouth system.

Various types of graphics displays from many manufacturers were introduced in the mid-60's, opening the door to new video effects. Thus, we find a video pool game developed at RCA (1967), a ball-and-paddle game by Ralph Baer at Saunders Associates (1967, later to become the Magnavox Odyssey home video game in 1972), a rocket car simulation by Judah Swartz at MIT (1968), a graphic flight simulation by Evans & Sutherland (1969),

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a lunar lander game at DEC (1969), and a device to permit
computer output and standard television video on the same display
at Stanford (1968).

In the October 1970 issue of Scientific American, Martin
Gardner devoted his mathematical games column to a description of
John Conway's "Game of Life."  Easily programmed, within weeks,
it began to appear on virtually every video computer terminal in
the country.

In the late 1960's, the National Science Foundation was
attempting to encourage the use of computers in secondary
schools to improve science education.  One of the notable NSF-
funded projects that produced scores of simulation games in
science and social studies was the Huntington Computer Project
directed by Ludwig Braun at Brooklyn Polytechnic Institute (later
at SUNY, Stony Brook).  In the Project's "Malaria" simulation
game, for example, students must try to control an outbreak of
malaria in a Central American country using a combination of
various pesticides, innoculations, and treatment of the ill--all
without bankrupting the country.

Also in the late 60's, both Digital Equipment Corp, and
Hewlett-Packard started major marketing efforts to sell
computers to secondary and elementary schools.  As a result of
this, both companies sponsored a number of small scale projects
to write computer games and simulations in various fields, many
of which were released in the early 1970's.  In DEC's "King"
game, for example, players decide how much land to buy, sell, and
cultivate each year, how much to feed the people, while dealing
with problems of industrial development, pollution, and tourism.

Meanwhile, on the recreational front, in 1971, Nolan Bush-
nell rewrote Spacewar as a coin-op game called Computer Space
which was marketed by Nutting Associates.  Too complicated for
the average player, only 1500 units were sold and the game was
not successful.  A year later, Bushnell's next project, the Pong
coin-op game, was considerably more successful and was the
foundation of Atari Corp.

Also in 1972, Willy Crother and Don Woods wrote a game
for the DEC PDP-10 which they simply called "Adventure."  The
game, the first in the interactive role-playing fantasy genre,
was unbelievably addictive and players consumed vast gobs of
timesharing computer time on whatever system had it loaded.

1972 also saw the first issue of Bob Albrecht's People's
Computer Company newsletter which, along with material for
teachers and students, included many small Basic games each
issue.  A year later DEC published the book, "101 Basic Computer
Games" by David Ahl, which, in 1978, became the first computer
book of any kind to sell 1 million copies.

Ahl left DEC in 1974 and started Creative Computing, the
first personal computing magazine and the first magazine to
publish three or four major games every issue.  Also in '74, Ted
Nelson published the book "Computer Lib/Dream Machines"  while,
at the MITS company in Albuquerque, NM, Ed Roberts was putting
the final touches on the first mass produced personal computer
kit, the Altair 8800.

With the widespread availability of affordable video game
systems and personal computers, it looked as though there was no
top to the computer and video games market.  Atari introduced the

home version of Pong in 1975 and it was followed a year later by literally hundreds of imitators. Removable cartridge home games were first introduced by Fairchild in 1976, followed by Bally, Atari, and others a year later. By 1982, over 100 companies had entered the market with game systems or cartridges.

Also by 1982, the $6 billion in quarters put into coin-op games exceeded the gross take of all professional sports combined, bouyed by such games as Space Invaders (1978), Pac-Man (1980), Defender (1981) and scores of other mega-hits.

The kit era of personal computers lasted only two years and by 1977 manufacturers of self-contained, assembled computers like Commodore, Apple, and Radio Shack took the market by storm. This opened the computer game floodgates as the cost of entry was so low. All one needed was a personal computer, some programming smarts, and a few hundred bucks to buy some magazine ads. In more than one case, bright teenage programmers started game companies and hired their parents as employees.

However, all was not well in gameland and in 1983 the bubble burst. Many factors are responsible for the crash: too many me-too games, scores of companies with no management or financial expertise, jaded game players, public backlash against sleezy arcades, and just too much expansion too fast.

After a disasterous two-year downward spiral, it looked to many like computer games were in the grave. In April 1985, the Frost & Sullivan market research firm rated computer and video games as having the least potential of 24 high technology markets. The video and home computer games market was judged to have been a passing fad and manufacturers seeking profitable

opportunities were advised to turn their attention elsewhere.

Apparently, Nintendo didn't read (or heed) the report since they chose 1985 to introduce their home game system. Also, Accolade, Electronic Arts, Strategic Simulations, and other computer game companies started to release more games in the IBM PC format even though the PC was then considered to be primarily a "business" machine. These turned out to be wise decisions.

According to market surverys, Nintendo games were the most wanted Christmas presents three years in a row (1987-89). Two new game formats were introduced in 1990: 16-bit systems by Sega and computer/compact disc games by NEC, and the home video game market---far from being a fad---was healthy and growing again.

The steep and continuing decline in the prices of PC clones put them within reach of most home users thereby simplifying the life of game designers and manufacturers. No longer did manufacturers have to make a different game version for Apple, Atari, Commodore, and Tandy computers when a PC version would reach 90% of the users. Bouyed by a choice of new and innovative games, the market steadily rebounded from its 1985 trough.

Where to from here? It's anybody's guess. Obviously, new games will use the latest technology--laser discs, multi-channel sound, voice synthesis, speech recognition, and much more. Today, real-time flight simulation games almost exactly duplicate the situation faced by actual pilots. Tomorrow, we will be able to eliminate the word "almost."

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Photo Captions

Fig. 1. In Accolade's "Test Drive" game, players can choose to drive various cars on a variety of demanding tracks and courses.

Fig. 2. In "Yeager," a typical flight simulator, players must learn to land on a crrier deck, tough even for seasoned pilots.

Fig. 3. "Hardball," a realistic sports simulation provides realistic player animation, instant replays, complete player and team statistics, and five field perspectives.

Fig. 4. Computer versions of virtually every card and board game such as this version of Scrabble are available for one or more players.

Many ways of categorizing video games:

Michael Rubin in Defending the Galaxy:
          Driving games (Turbo, Night Driver)
          Bottom Movement games (Space Invaders, Centipede, Missile
               Command)
          Free Flight games (Asteroids, Rip Off)
          Maze games (Pac-Man, Berzerk, Venture)
          Horizontal Offense/Defense (Stargate, Zaxxon)

          (but then where do you put Qix, Frogger, Make Trax,
               Football, or Tron?)

Steve Bloom in Video Invaders:
          Space Invaders-type games (shooter moves side to side)
          Defender-type games (game motion horizontal)
          Space Wars-type games (use vector graphics)
          First-person games (player is inside a vehicle)
          Pac-Man-type games (cartoon or "cutsey" games)
          Climbing games (like Donkey Kong and Frogger)
          Adventure games (Wizard of Wor, Venture, etc.)
          Games that defy classification (Qix, Tempest)

Ken Uston in Buying and Beating the Home Video Games:
          Hand-Eye Coordination (Asteroids, Space Invaders, Stargate)
          Mental Challenge (Video Chess, Backgammon, Pac-Man)
          Other (Adventure, Superman)

          (too simplistic)

Other categorizations have similar problems:
          Sports (can include games as diverse as Basketball, Grand
               Prix, and Skeet Shoting)
          Military (Tank, Commanado, and Missile Command would be in
               this category. but all are quite different)
          Fantasy (Berzerk

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1972 - NOV - ATARI PONG (10,000 + 90K KNOCK OFFS)

1972 - NOV ₂         (BLOOM - ~~MAR~~ '72)
1973 ODYSSEY 100 (TENNIS, HOCKEY, SMASH)    (SOLD (100K AT $100)
1974 NOV - ATARI: TANK                       BY 1975, MAGNAVOX
1975 HOME PONG (BLOOM: 1973 - SOLD 100K)     LOST $22M ON
1975 MIDWAY: GUN FIGHT  } REVITALIZE INDUSTRY STALE ON PONG    VIDEO GAMES)
1976    "        SEA WOLF
1976 FAIRCHILD CHANNEL F
     APPROX. 60 DEDICATED GAMES AT CES - MOST USE GI AY38500
                                                          CHIP
1977 ⌐ RCA              } (DESIGN FINALIZED IN 1976)   (ODYSSEY
     L→ (JUNE CES)                                      BG 7514)
1978  ATARI VCS                   #1  1979 ON
      ODYSSEY 2

      BALLY ARCADE

      MIDWAY: SPACE INVADERS

      CINEMATRONICS: SPACE WARS    #1 IN THE YR.
           USED "VECTORBEAM" VECTOR GRAPHICS

      ~~██████~~


1980   MATTEL (INTELLIVISION)      #2 IN 1981

       MIDWAY: PAC-MAN

| COMPUTER | COIN-UP | HOME VIDEO |
|---|---|---|
| 1957 TENNIS | | |
| POOL | | |
| 1962 POOL: SPACE WAR | | |
| | | |
| 1970 LUNAR LANDER | | |
| 1971 | COMPUTER SPACE | |
| 1972 | PONG | ODYSSEY |
| 1973 | | |
| 1974 | TANK | ODY 200 |
| 1975 | (MIDWAY) GUN FIGHT | PONG  300 |
| 1976 | SEA WOLF | BREAKOUT  4000 |
| 1977 | | ATARI VCS |
| 1978 (APPLE: SPACE WAR) | SPACE WARS  SPACE INVADERS | ODYSSEY² |
| 1979 | | |
| 1980 | PAC-MAN | |
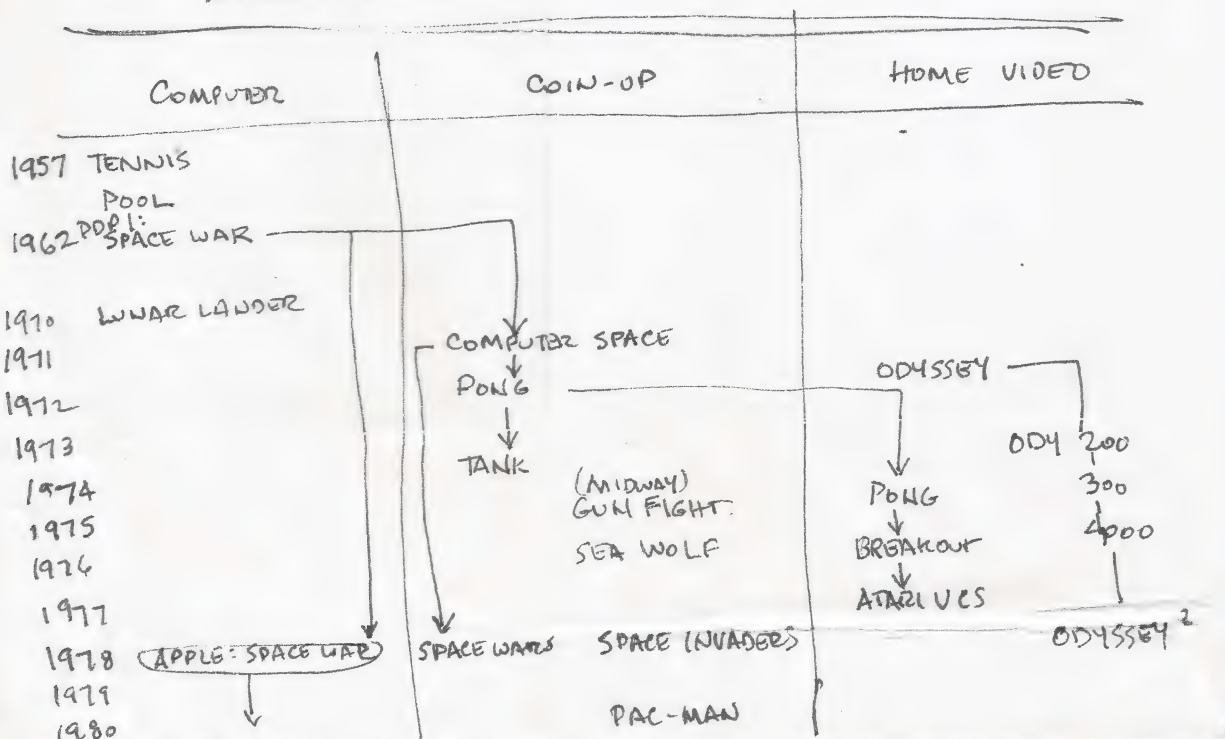
1950

1951 — WHIRLWIND I
USES CRT TO DISPLAY
GRAPHIC AND ALPHANUMERIC
OUTPUT - MIT

"COMPUTING MACHINERY + INTELLIGENCE"
ALAN TURING

'52 HEX
E.F. MOORE +
SHANNON

RADAR / MAP SIMULATIONS
BOB CHAPMAN, ETAL
RAND AIR DEFENSE LAB

VIDEO                    ALPHANUMERIC

1952

'53 CHECKERS       '54 BLACKJACK - IBM
ARTHUR SAMUEL      AEC LAB,        701
IBM 701            LOS ALAMOS, NM

1954    POOL

'53 "THE COMPLETE
STRATEGYST"
by J.D. WILLIAMS PUBLISHED)
RAND CORP

1956    UNIV. MICHIGAN

CHESS (MANIAC-I)
KISTER ET AL.
LOS ALAMOS

1958    TENNIS (ANALOG)

HIGINBOTHEN

'55 HUTSPIEL - THEATER LEVEL WAR GAME
NATO v USSR
RESEARCH ANAL CORP., McLEAN, VA

BROOKHAVEN NAT'L LAB

CAI USING
'64 CRT +
LIGHT PEN
AND EAR
PHONE
(SCI AM
257)

PATRICK
SUPPES -
IBM

1960    '64? CRT COMBINES
COMPUTER DATA
WITH PROJECTED
BACKGROUND FOR MILITARY
BUNKER-RAMO    GAMES
(SCI AM
246)

'61 SKETCHPAD
(IVAN SUTHERLAND)
LINCOLN LABS (MIT)

'59 MANAGEMENT GAME (BENDIX G15)
COHEN, CYERT, DILL, ETAL
CARNEGIE-MELLON UNIV.

1962    '63 CDC 6600
SUPER COMPUTER 5/62
4 VIDEO DISPLAYS
(BIT BY BIT 219)    SLUG

SPACE WAR (PDP-1)
RUSSELL, GRATZ, KOTOK
MIT    SHAG    ALAN

'61 FIRST TIMESHARING - MIT/IBM 709

'67 ELIZA
EDWARD WEISENBAUM, MIT

1962?
1965    COMPUTER + VIDEO
ON SAME DISPLAY
STANFORD
1967    SAIL
(HACKERS 133)

POOL

RCA

'68 ROCKET
CAR DISPLAY
JUDAH SWARTZ
MIT (SCI AM 61)

'69        AIRCRAFT
FLIGHT SIM'L
NAVAL TRAINING
DEVICE CENTER

'52 MILITARY GAMES

'65 EDUCATIONAL GAMES (BASIC)
KEMENY & KURTZ    GE-265?
DARTMOUTH COLLEGE

1971    11/71 INTEL 4004

COMPUTER SPACE (COIN-OP)

BUSHNELL

NUTTING ASSOCIATES

'69 LUNAR LANDER (PDP-8)
DIGITAL EQUIP. CORP

8" FLOPPY DISK
IBM

'70 SCIENCE + SOCIAL SIMULATIONS (BASIC)
BRAUN
HUNTINGTON COMPUTER PROJECT,
SUNY, STONYBROOK

1972    PONG (COIN-OP)

BUSHNELL

ATARI

6/70 GAME OF LIFE
JOHN CONWAY

'68 "GAME PLAYING
WITH COMPUTERS"
by DONALD SPENCER

ADVENTURE (PDP-10)
WILL CROTHER, DON WOODS
STANFORD/XEROX

ODYSSEY (ANALOG, HOME)

MAGNAVOX

10/72 "PEOPLE'S COMPUTER CO."
BOB ALBRECHT, MENLO PARK, CA

'73 INTEL 8008

1975    6/75 PONG (HOME VERSION)

ATARI

'77 TRS 80 MODEL I

# TECHNOLOGY

| CIRCUITS | DISPLAYS | INTERNAL STORAGE |
|----------|----------|------------------|
| VACUUM TUBE | POINT PLOTTING | CORE |
| TRANSISTORS | | |
| ~~DIODES~~ | | |
| ~~CIRCUITS~~ | | |
| | VECTOR/ CALIGRAPHIC | SOLID STATE |
| INTEGRATED CIRCUITS | RASTER SCAN | |
| | | |

# VIDEO GAMES

| | COIN-OP | COMPUTER | | | SELF-CONTAINED | |
|---|---|---|---|---|---|---|
| | | MAINFRAME | MINI | MICRO | SPEC. PURPOSE | HOME TV |
| 1954 | | POOL (UNIV. MICH.) | | | | |
| 1958 | | | | | TENNIS HIGINBOTHEN (BROOKHAVEN) | |
| 1962 | | | MAY SPACEWAR (RUSSELL, M.I.T.) | | | |
| 1966 | | | | | | TENNIS (BAER SAUNDERS) |
| 1967 | | POOL (RCA) | | | | |
| 1971 | COMPUTER SPACE (BUSHNELL, NUTTING) | | | | | |
| 1972 | PONG (BUSHNELL, ATARI) | | LUNAR LANDER (D.E.C.) | | | ODYSSEY (MAGNAVOX) |
| | TANK '74 | | | | | |
| 1975 | SPACE INVADERS | | KIT COMPUTERS | ALTAIR IMSAI SWTPC | | 6/75 TELEGAME/PONG (SEARS/ATARI) 12/75 ODYSSEY 100,200 (MAGNAVOX) |
| 1976 | BREAKOUT LE MANS | | | (PROCESSOR TECHNOLOGY) | | |
| 1977 | POOL | | SELF-CONTAINED COMPUTERS APPLE II COMMODORE PET TRS-80 MODEL I | | | "PROGRAMMABLE" GAMES ATARI VCS ODYSSEY² MATTEL INTELLIVISION |
| 1978 | | | BREAKOUT (APPLE) | | | |
| 1979 | LUNAR LANDER ASTEROIDS | | TENNIS PONG SPACEWAR (APPLE) SPACE INVADERS (APPLE) | | | ACTIVISION |

1980

? LUNAR LANDER
(TRS-80?)
? SPACEWAR2
(APPLE)
POOL
(THORN/ATARI)

DEDICATED AND BALL &
PADDLE GAMES DIE OUT

1981    CENTIPEDE        IBM PC         ? PROGRAMMING
                                          CARTRIDGES +
                                            KEYBOARDS

1982                    ? VIC-20      ? VECTREX
                       BLURB LINE
                   BETWEEN MICROCOMPUTERS
                    + VIDEO GAMES

1983

1984

1985

1986

Up to 1977

Pong

Tank (battle)

Jet fighter

Anti-aircraft

Pursuit

Cops 'N Robbers

Gotcha (chase game in a maze)

Crossfire (conserve momentum)

Trak (driving)

Le Mans

Steeple Chase (horse race

Stunt Cycle (motorcycle jumping)

Fly Ball (baseball)

Soccer

Home

1970

1971

1972        1/27/72 built - introduced 5/72
            Magnavox Odyssey ITL 200 (Sales thru 1975 - 340,000 units)
            21,000 units (Dataquest) Spent $8 million on promo

1973        Odyssey 125-150 k units

1974        Odyssey 125,000 units

                  Odyssey 70K units
1975   6/75  Atari Pong (Sears ⅝ Telegame)              First Dimension
            11/75 Odyssey 100 - Tennis + Hockey          Executive Games
            12/75    "    200    "      "   , Smash

1976

1977        Atari VCS
            Odyssey 2
            Mattel Intellivision

1978

1979        Activision

1980        Volume low for Hk producers (Electronics 9/80)   Taiwan producers
            No interest in ball + paddle games               leaving market
            Trend toward programmable games                  Singapore out of
            APF Imagination Machine                          market

1981

1982

## Computer

| 1962 | Spacewar | Steve Russell |
| 1958 | ~~title~~ Tennis | Willy Higinbotham |
| ~~1948~~ 1967 | Pool | RCA |
| 1966 | Tennis | Ralph Baer |
| 1954 | Pool | Univ of Michigan |

# TOTAL MARKET SIZE AND
## SHARE OF PURCHASES (6-MO PERIODS)

Atari

Coleco

Mattel

Odyssey

~~1/82~~ ~~6/83~~ ~~12/83~~

| | NFO 1/84 STUDY | NFO 7/84 STUDY |
|---|---|---|
| | VIDEO GAMES OWNED | |
| Purchased before 1982 | 3510 | Before '83  7599 |
| "  in  1982 | 5225 | in '83  3231 |
| "  1/83 - 6/83 | 1075 | 1/84-6/84  580 |
| 7/83 - 12/83 | 2760 | |
| 1983 | 3878 | |
| | 12943 | 11402 |

# CATEGORIES OF GAMES

| | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPACEWAR | SPACEWAR COIN-OP | | | | | | | ASTEROIDS COIN-OP | | SPACEWARE MICRO | | ? HOME TV | | | | |
| BALL & PADDLE | | PONG COIN-OP ODYSSEY HOME TV | | | | BREAKOUT | | BREAKOUT MICRO | | | | | | | | |
| ? MANEUVER & SHOOT | | | | TANK | GUN FIGHT / SEA WOLF | | COMBAT | | | | | | | | | |
| CHASE IN MAZE | | | | GOTCHA | | | | | | PAC MAN | | DIG DUG | | | | |
| DRIVING | | | | | | TRAK / LE MANS / NIGHT DRIVER | | | | | | | | | | |
| HORSE RACE | | | | | | | STEEPLE CHASE | | | | | | | | | |
| MOTORCYCLE | | | | | | STUNT CYCLE | | | | | | | | | | |
| BASEBALL | | | | | | | FLY BALL | | | | | | | | | |
| FOOTBALL | | | | | | | | FOOTBALL | | | | | | | | |
| SOCCER | | | | | | | WORLD CUP SOCCER | | | | | | | | | |
| FLYING | | | | | | | | | | FLIGHT SIMULATOR | | | | | | |
| SHOOT FROM MOVABLE BASE | | | | | | | | SPACE INVADERS | | CENTIPEDE GALAXIAN MISSILE COMMAND | | | | | | |
| ROLE PLAYING | | | | | | | | | | | | | | | | |
| POOL | | | | | | | | | | | | | | | | |
| CATCH FALLING OBJECTS | | | | | | | | AVALANCHE | | | KABOOM | DONKEY KONG | | | | |
| FANTASY MAZE | | | | | | | | | | QIX  ZAXXON  TEMPEST  BATTLE ZONE  DEFENDER | | | | | | |